

WIRELESS CONTROL FOR CREATION OF, AND COMMAND RESPONSE TO, STANDARD FREIGHT SHIPMENT MESSAGES

This application claims the benefit of the following copending applications and their filing dates: US 60/480,980 filed 24 May 2003; US 60/582,258 file 25 June 2003; and US 60/482,889 file 26 June 2003.

Field of the Invention

This invention relates to remote control of freight assets during transit or other states.

Background of the Invention

Condition of freight assets such as refrigeration temperatures, locations, etc, have in the past been detected by sensors, and various alarms and signals alerted attendants and managers of adverse conditions. Such systems have been cumbersome and presented difficulties for remote managers and attendants because of limitations of the communication systems.

Summary of the Invention

An embodiment of the invention involves transmitting sensed conditions of freight assets via one format suitable for the sensors to a monitoring system, which sends the data to a user utilizing another, user compatible, format.

Another embodiment involves the monitoring system comparing the sensed conditions with requirements from a user and sending the discrepancy to the user.

Another embodiment involves the monitoring system commanding devices of the freight asset to correct discrepancies.

These and other aspects of the invention are pointed out in the claims. Objects and advantages of the invention will become evident from the following detailed description when read in light of the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a general schematic diagram illustrating an overall system embodying the invention.

Fig. 2 is a schematic illustration of one embodiment of the invention.

Fig. 3 is a representation showing the operation of Fig. 2.

Fig. 4 is a schematic illustration of another embodiment of the invention.

Fig. 5 is a representation showing the operation of Fig. 4.

Fig. 6 is a schematic illustration of yet another embodiment of the invention.

Fig. 7 is a representation showing the operation of Fig. 6.

Detailed Description of Preferred Embodiments

Fig. 1 is a schematic illustration of an over all system embodying the invention.
Here, a multiplicity of users US1, US2, ... USn connect over respective communication links to a wireless monitor system MS1. There may for example be one hundred users so that the character n represents one hundred. The communication links are preferably wire or cable but can also be wireless, internet, satellite, or other communication paths.

The wireless monitor system MS1 communicates over various communication links such as satellite, cell phone, radio, etc. with fleets of freight assets FA1, FA2, ... FAn. The number of freight assets FA1, FA2, ... FAn may for example be one thousand for each user US1, US2, ... USn, for a total one hundred thousand freight assets.

The wireless monitoring system MS1 responds to signals from the users US1, US2, ... USn, and in turn sends signals to the users, and also communicates with the freight assets FA1, FA2, ... FAn to furnish wireless monitoring and tracking of the freight assets. The wireless monitoring system MS1 provides services to the multiple users simultaneously and retains database information regarding a fleet of freight assets associated with each of the users. The wireless monitoring system MS1 serves as a communications platform for sending polling inquires to the individual freight assets FA1, FA2, FAn over the multiple communication networks, such as satellite, cellular, and radio frequency networks. The wireless monitoring system MS1 communicates via EDI standards in multiple communication platforms to a collection of freight assets FA1, FA2, ... FAn for multiple system users. The wireless monitoring system MS1

makes use of the economy of scale for supporting different communications networks in different system users for similar application.

The communications may be carried out over multiple frequencies, using time division multiplexing where desired. The monitoring system MS1 maintains a database which determines the particular ones of the freight assets FA1, FA2, ... FA_n that are owned or belong to or are associated with the particular users US1, US2,...US_n. The system MS1 also maintains information concerning the particular event or condition within the freight asset that the user desires to be controlled. Each of the freight assets FA1, FA2,...FA_n includes an intelligent electronic device ED1 that serves to communicate one or more of a number of monitored conditions within the freight assets. Such conditions may for example include any one or more environmental or ambient circumstances such as temperature, location, speed, direction of movement, vibration, load, humidity, ambient gas, illumination, radiation, etc.

This arrangement utilizes wireless intelligence on a freight asset to evaluate status conditions that automatically trigger transmissions and generate industry standard freight industry messages, which may be used for tracking and monitoring of freight assets and shipments. A corollary of the invention utilizes industry standard freight shipment messages that are evaluated against wireless messages transmitted from a freight asset with wireless intelligence to send command actions to the asset, which change or alter a monitored freight condition. Another corollary involves a method that

permits a user to create an industry standard freight message by sending a wireless notification to an asset, which responds to the notification with a wireless transmission, and results in an industry standard freight message.

A detailed embodiment of the invention appears in Fig. 2. Here, a specialized aspect of this invention involves a particular condition of a freight asset FA1, monitored in real-time, which creates an alarm or event condition concerning the asset within an intelligent electronic device ED1, by virtue of the intelligence of that device. The freight asset FA1 may be any one or more conveyances such as a truck, tractor, bus, railroad car, ship, boat, and their contents, and also include any one or more of warehouses or storage facilities and their contents. The monitored condition includes any one or more of environmental or ambient circumstances such as temperature, location, speed, direction of movement, vibration, load, humidity, ambient gas, illumination, radiation, etc. The alarm or event condition is sent via an encoded wireless communications link CL1 to a wireless monitor system MS1 having a database DB1. The wireless monitor system may be a ground based receiving and transmitting service station or facility with both wireless and groundline, such as wire, cable, optical fiber, etc. communication ability. The wireless message from the electronic device ED1 is encoded particularly for the bandwidth restrictions of the wireless communication link CL1. The wireless message may be communicated by radio waves, satellite, microwaves, laser, etc. The wireless monitor system MS1 receives the wireless freight message FM1 and contains a translator TR1 that formats the message into an industry

standard user format, such as Electronic Data Exchange (EDI) or Extensible Mark-up Language (XML) freight message FM1 containing relevant information regarding the asset. The translator TR1 transmits the message FM1 in the user format to users at a user system US1 having information systems that accommodate the standard user format message types such as EDI or XML, and have a database DB2. The user system may be the headquarters or communication center, or executive office of a user whose managers require the information for their operation. This process permits the intelligent electronic device ED1 of the monitoring system on the freight asset FA1 to transmit standard, "open systems" messages, which are delivered into the existing information systems of user's of freight equipment.

The device ED1 on the asset FA1 automatically evaluates a particular condition to provide information that is normally derived from other sources (i.e. wayside monitoring systems that tell when an asset passes by and human creation of events that occur at under specific conditions). One example of this embodiment of the invention involves the local knowledge of location of the asset FA1, by use of a geographic positioning system (gps) sensor or equivalent, when the asset FA1 moved into a user designated location, where the asset FA1 would generate a wireless message, formatted into an industry standard message by the translator TR1 for delivery into the user system US1 and its database DB2. The newly formatted message from the translator TR1 contains information delivered from the asset FA1, including for example, gps

location, time of arrival or departure, and the condition of the freight (door position, temperature, set point temperature, presence of auxiliary equipment, etc.).

Another example of this process involves a laborer changing the temperature set point on the asset FA1, such as a refrigerated trailer or railcar, which causes the device ED1 to generate an encoded wireless message that the translator TR1 ultimately delivers as a standard industry message FM1 to the user at user system US1 with its database DB2. With these given messages, the user may compare the wireless generated information from equipment located on the asset to shipping records and provide immediate context to the shipment without the need for local reading devices or operator inputs. Fig. 2 illustrates steps in the operation.

Another embodiment appears in Figs. 4 and 5. This involves the generation of a wireless command by the monitor system MS1 to the asset FA1 to change a condition based on a discrepancy between an industry standard freight message FM2 and information transmitted from the freight asset FA1 using encoded wireless communications via the device ED1. Upon the receipt of the industry standard freight message FM2 generated by the user system US1 with its database DB2 specific to an individual freight asset FA1, the monitor system MS1 compares recent encoded wireless messages from the asset FA1 via the electronic device ED1 to the newly received freight message FM2. Should an exception occur resulting from a discrepancy between the originating freight message FM2 and the encoded wireless

message, which involve a specification for the freight shipment, such as a destination, temperature setting, routing violation, and recent wireless messages, then the monitor system MS1 sends a wireless command to the intelligent electronic device ED1 on the asset FA1, which changes the condition of the asset FA1. In one example, a user sends an industry standard freight message FM2, via the database DB2 to the monitor system MS1, specifying a specific temperature setting for a commodity contained within a specific freight asset FA1, and the temperature setting is compared to, and found different from, a recently received actual temperature setting received via encoded wireless communications from the asset FA1 via the device ED1. Then an automatic command is sent to the intelligent electronic device ED1 instructing it to change the temperature set point to the newly prescribed temperature setting of the message FM2. Upon enacting the change in temperature, the electronic device ED1 sends an encoded wireless message confirming that the action took place. The translator TR1 in turn forwards this message in an industry standard freight message EDI or XML. Another example involves the automatic sending of a command to a unit to lock the freight doors once the asset has left a prescribed location delivered to the monitor system MS1 via an industry standard message.

Yet another embodiment appears in Figs. 6 and 7. This involves a method to create a standard freight industry message by accessing a monitor system MS1 and sending a command via wireless communications to an intelligent device attached to a freight asset. Upon receipt of the command from the user via monitor system MS1, the

intelligent device ED1 creates a transmission that results in an industry standard freight message in a method similar to the embodiments above.

In these embodiments, the standard freight messages FM1 involve, for example, bills of lading (404), waybills (417), Terminal Operations and Intermodal Ramp Activity (322) messages and car location messages, which contain relevant information about freight shipments. These messages, and related messages, are created from encoded wireless messages via satellite, cellular or radio frequency communications in the first embodiment, Figs. 2 and 3. In an embodiment, these messages, and related messages, specify the actual conditions of the freight, and the wireless communications links assure, via control mechanisms, that the freight shipment meets the specification.

The invention permits real time transmission of freight asset conditions, freight control signals, and confirmation signals between wireless, e.g. satellite, transmission formats and standard message formats EDI or XML.

The database DB1 stores all incoming and outgoing messages to and from the wireless monitor system MS1. If the monitor system MS1 receives a message from the user system US1 with its database DB2 to alter the status of the freight asset FA1, the database DB1 stores the command as the translator TR1 transmits the message to the electronic device ED1. When the latter effects the requested change in the status of the freight asset FA1, it sends back a confirmation to the monitor system MS1 which

compares the resulting change with the command stored in the database DB1 to assure compliance. The translator TR1 then sends the result via standard message formats EDI or XML to the user system US1 with its database DB2.

The database DB1 also stores contact information for alarms, as well as user preferences. The user may for example be a freight forwarding company, a railroad company, a truck company, a refrigeration company, etc.

The term freight assets may refer to a freight cars, motor trucks, the freight carried, their temperatures, destinations, and/or other conditions of operations. The freight assets can also include freight equipment, and its weights, loads, and pressures.

In Fig. 6 the user may address the wireless monitor system MS1 directly by telephone, e-mail, or web-address, etc.

The electronic device ED1 may be part of the freight assets FA1, FA2, ..., FA_n, and may vary in the form from freight asset to freight asset.

While embodiments of the invention have been described in detail it will be evident to those skilled in the art that the invention may be embodied otherwise.